URBAN EUROPE

ACUTE - Accessibility and Connectivity Knowledge Hub for Urban Transformation in Europe

WP2 – Research Synthesis

D2.3 Research synthesis

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Executive Summary

This report synthesizes the research approaches of the 15 projects funded through the first funding call of the ERA-NET Cofund Urban Accessibility and Connectivity. It does so based on an analysis of the call text, project applications, progress reports, as well as interviews, a questionnaire, and a word frequency analysis reported in other ACUTE deliverables. Drawing on the analysis—structured around questions on visions and objectives, conceptualizations of accessibility and connectivity, problems covered, project consortia, experiments, impact logics, and the urban context—the report also identifies research and implementation gaps and recommends actions to enhance the portfolio's transformative capacity.

The analysis highlights three gaps in the project portfolio: a power imbalance, where research organizations dominate decision-making while sidelining local stakeholders despite their importance for long-term impact; an innovation bias, meaning the portfolio emphasizes niche innovations over destabilizing existing regimes; and weak conceptualization, as projects often fail to define key concepts and address the complexities of transferring outcomes to other urban contexts.

To address these gaps, the report recommends that Driving Urban Transitions explore new approaches to ensuring that local stakeholders are actively involved in project formulation, execution, decision-making, and afterlife, and issue funding calls that accommodate a broader spectrum of project approaches in terms of experimentation and participation. The calls should also require applicants to better clarify their visions, theories of change, conceptual frameworks, and impact strategies.

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1. Introduction

This report constitutes deliverable 2.3 of the project Accessibility and Connectivity Knowledge Hub for Urban Transformation in Europe (ACUTE), established in 2022 by the Joint Program Initiative Urban Europe (JPI Urban Europe) under the ERA-NET Cofund Urban Accessibility and Connectivity (ENUAC) framework. Departing from work reported in two internal project deliverables—2.1 Information needs and 2.2 Analytical framework—this report first synthesizes the research and innovation approaches of the 15 projects funded through ENUAC's 2019 call for project applications. It then identifies research and implementation gaps within this portfolio.

The report primarily stems from work package two—Research synthesis—but also draws on findings from other project deliverables, particularly deliverable 1.4, Showcase of regional, national, European, and international projects, ideas, and initiatives. The section of the analysis focusing on urban living labs as a research and innovation approach, along with the conclusions on this theme, is, moreover, presented in full in a manuscript submitted for publication in an international academic journal (see Smith & Lindkvist forthcoming).

The report is divided into seven sections, of which this is the first. The following sections present a brief background to the analysis and its aims, the theoretical points of departure, the applied methods, our findings, a discussion on the findings, and finally, our recommendations.

2. Background and objectives

JPI Urban Europe was launched in 2010 by the European Commission with the goal of establishing an arena capable of supporting research on a scale that individual nations could not achieve alone. The initiative is intended to produce results on a wider scale, leading to more complex findings that can be compared across countries.

One of the key instruments supporting this initiative is ENUAC, a so called cofund which aims to create and strengthen a transnational ecosystem for interdisciplinary and transdisciplinary research and innovation, while also fostering improved cooperation between science and policy. ENUAC is intended to drive the transition toward sustainable and inclusive models for urban accessibility and connectivity. The cofund plans to issue multiple funding calls for research and innovation projects, alongside various supporting measures. The first call was launched in late 2019. 86 project proposals were submitted during the initial evaluation phase. Of these, 37 were invited to submit full proposals, and 15 were ultimately selected for funding.

Driven by the need for policy actors—such as the Driving Urban Transitions (DUT) program—to better understand the research and innovation landscape and how it responds to calls for project applications, as well as a broader need to understand the potential and limitations of collaborative, experimentation-oriented research in addressing urban sustainability challenges, work package two had three objectives, which this report sets out to address:

- Synthesize what kind of research is encouraged and developed within the ENUAC portfolio by providing a high-level overview of the scopes, activities, and outputs of the 15 funded projects
- Identify research and implementation gaps by describing what the current portfolio is not addressing, even though it may be requested by practitioners or needed to facilitate systemic transformations, according to the literature on sustainability transitions
- Explore what the DUT could do to improve the transformative capacity of the ENUAC portfolio by analyzing how its actions shape the projects

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As such, this report complements the outputs from the other ACUTE work packages. These include providing an overview of the ENUAC projects (work package one), investigating practitioner perspectives (work package three), offering strategic support for DUT (work package four), and recommending next steps for the ACUTE knowledge hub (work package five).

3. Theory

The theoretical starting point of the analysis drew on four concepts: sustainability transitions, accessibility, connectivity, and urban context. These concepts are briefly introduced below.

3.1. Sustainability transitions

The analysis is grounded in the multi-level perspective on sustainability transitions (Geels 2002). This framework suggests that for innovations to transform socio-technical systems, coordinated and complementary changes are needed across three distinct levels: landscapes, regimes, and niches (see Figure 1). The landscape refers to external factors beyond the direct control of actors at the regime and niche levels. External changes, such as climate shifts, can destabilize regimes—those institutional and structural frameworks that provide stability and context for sectors like urban mobility (Fünfschilling & Truffer 2014). Such disruptions create opportunities for niche innovations to emerge and, over time, potentially replace or transform these regimes (Markard et al. 2012). Niches, in this perspective, are understood as protected spaces where innovations can develop without the immediate pressures of established regimes (Kemp et al. 1998).

Innovation is thus seen as a multi-stage process in which ideas are transformed into products, services, or processes that are adopted, utilized, and recognized as novel within a specific context (Rogers 1995). This approach goes beyond focusing solely on technological innovations, addressing broader aspects of societal transformation.

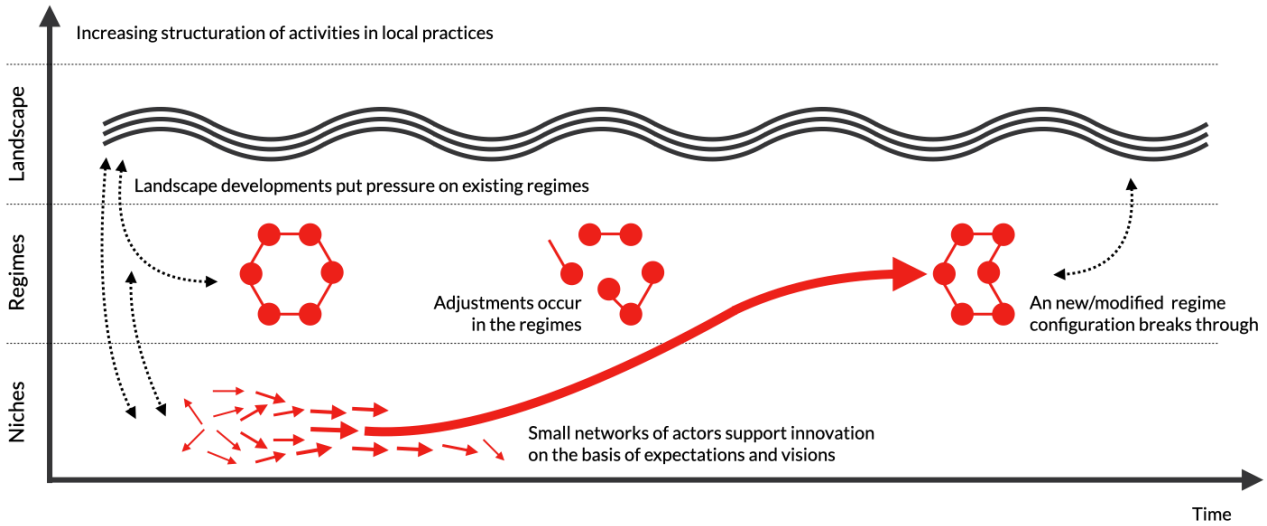

Figure 1: The multi-level perspective on socio-technical transitions, adopted from Geels (2002).

One of the key analytical and prescriptive frameworks within sustainability transition studies is the transition management framework (Loorbach 2007; 2010). It assumes that regime actors tend to reinforce their own positions, thereby maintaining the status quo. To counter this, the framework offers a structured approach for challenging regimes by fostering niche innovations and exploring potential future transitions (Rotmans et al. 2001). It outlines four types of governance activities: **long-term strategic actions**, such as developing visions and establishing arenas for collaboration; **tactical actions**, such as building coalitions and shared

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agendas; **operational actions**, including mobilizing actors and experimenting; and **reflexive actions** focused on evaluation (Loorbach 2010). In recent years, the framework has been expanded to emphasize activities focused on destabilizing existing regimes as well (e.g., Hebenick et al. 2022; Loorbach 2022).

3.2. Accessibility and connectivity

There is extensive literature on accessibility and connectivity. These concepts aim to capture the ease with which people, places, goods, services, and opportunities are linked to enhance exchanges or connect people with opportunities in different locations.

There is no universally agreed-upon definition of **accessibility**, though some general principles are widely accepted (Miller 2018, p. 551). Guers and van Wee (2012, pp. 208-209) define accessibility as "the extent to which land-use and transport systems enable (groups of) individuals to reach activities or destinations by means of a (combination of) transport mode(s) at various times of the day (from the perspective of persons), and the extent to which land-use and transport systems enable companies, facilities, and other activity locations to receive people, goods, and information at various times of the day (from the perspective of activity locations)," identifying four key components: land-use, transport, temporal, and individual factors (Guers & van Wee 2004, in Guers & van Wee 2012, p. 209).

Urban connectivity primarily focuses on how different urban areas are linked (Korkmazyürek et al. 2023; Zhou & Zhou 2020), or how the urban fabric and street network are integrated to enhance flows through the built environment (Mohamad & Said 2014; Nel et al. 2019). This includes supporting multiple intersections through well-integrated street networks, clear street hierarchies, and safe, secure pedestrian and bicycle pathways. Connectivity is also used to understand how digital connections and grids are designed to support various services, such as micro-mobility (Folco et al. 2023), or to measure traffic and passenger flows. Areas with low connectivity in a network system often become points of disturbance, such as congestion, because no additional roads or streets are available to alleviate the weak spots. Increased connectivity offers alternative routes in the built environment, contributing to more resilient transport systems, where network redundancy is described as a "diverse number of elements that can fulfill the same or similar functions" (Nel et al. 2018, p. 4 and p. 923). However, this should not only be understood as more streets or roads, but also improved access to diverse modes of transport. Connectivity networks are structured hierarchically, with finer-grained pathways connected to superior routes, allowing both flexibility and efficiency (ibid.).

3.3. The urban context

The term “urban” has traditionally been defined by the scale, density, and heterogeneity of cities (Wirth 1938 in LeGates and Stout 2015, p. 116), which contributes to an urban ecology (Jacobs 2011) that fosters citizenship, innovation, trade, and economic development. On a relative scale, cities can be understood as delimited physical sites controlled by local governments, or as nodes in complex networks of flows of resources, and governance is characterized by negotiations, collaboration, and co-creation among various stakeholders, including citizens (Brenner 2019; Massey 2012).

4. Method

4.1. Conceptual framework

A conceptual framework helps explain the aim and purpose of the research and can be understood as "a structure for organizing and supporting research ideas; a mechanism for systematically arranging abstractions; sometimes revolutionary or original, and usually rigid" (Weaver-Hart 1988, p. 11). With a conceptual framework, the researcher communicates the intentions of the research, providing a guide to how the research problem and research questions are connected, what kind of methodology supports the work being conducted, and the expected outcomes.

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Building on the theoretical concepts discussed in the previous section, the innovative ideas and concepts that the ENUAC projects sought to foster were framed as niche innovations designed to transform urban mobility and land-use regimes—specifically, the institutional frameworks that organize and coordinate actors and activities within these systems. The ENUAC portfolio was viewed as a network of interconnected projects, shaped by the dynamic interactions between application calls, project proposals, and funding decisions. These projects were intended to drive transitions toward enhanced urban accessibility and connectivity across Europe by supporting the growth of niche innovations, see Figure 2.

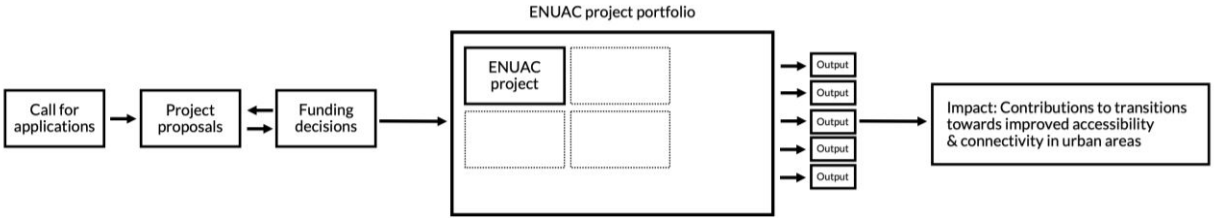

Figure 2: Overview of the conceptual model (Smith & Lindkvist forthcoming).

Departing from this model, the potential of the ENUAC portfolio to drive transitions toward enhanced urban accessibility and connectivity was assessed by evaluating two aspects. Firstly, how well the 15 projects collectively challenge existing rules and practices within urban mobility and land-use systems. Secondly, how effectively the projects: structure problems and establish collaborative platforms (strategic actions); develop agendas for change and envision sustainability, while identifying the necessary pathways for transition (tactical actions); implement and conduct experiments while mobilizing the resulting networks (operational actions); and evaluate these experiments and adjust based on lessons learned (reflexive actions).

An important delimitation here is that, for practical reasons, we assessed the ENUAC portfolio's potential to make impact in line with its underlying objectives, rather than evaluating its actual impact. The true long-term impacts often take years, or even decades, to fully materialize, especially in complex systems like urban mobility.

4.2. Data collection and analysis

The analysis was based on seven data sources and four analytical activities. The primary data included the 2019 call text, the applications for the 15 funded projects, and their first- and second-year progress reports. Additionally, the analysis was supported by a report summarizing insights from 24 interviews and 91 questionnaire responses (Deliverable 1.4), as well as a word frequency analysis of project proposals, progress reports, and two JPI Urban Europe strategy documents (Deliverable 4.1).

An important delimitation here is that, for practical reasons, the analysis was limited to the status reports and did not include other project outputs, such as academic papers, policy briefs, or final project reports. At the time of the analysis, the ENUAC projects were still ongoing, and the time-consuming nature of the quality analysis process, combined with the constraints of the work package budget, made it infeasible to include additional documents.

Inspired by the directed qualitative content analysis approach outlined by Hsieh and Shannon (2005, as cited in Selvi, 2019), a coding frame was developed based on the theories and concepts presented in the Theory section. This coding frame was structured into seven key questions:

1. What is the project about and what are its main *visions and objectives*?
2. How are the notions of accessibility and connectivity *conceptualized*?
3. Which accessibility and connectivity *problems* are covered, and how are these produced?

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4. How was the *consortium* built, and who is involved in what activities and in which roles?
5. How are *experiments* set up, and what are their objectives?
6. How are outputs from the project *transformed into action*, and by whom?
7. How is the *urban context* described, and how does this influence the project plan?

The questions were applied to the empirical material in two parallel processes. In one, the 15 projects were analyzed independently, while in the other, the questions were posed to the call text, see Figure 3. Insights from both analyses were summarized in brief reports and then reanalyzed in a comparative review, leading to tentative findings for the seven key questions. These findings were presented at two virtual validation workshops: one with ACUTE project members and another with ENUAC project representatives. Feedback from these workshops helped refine and validate the analysis, which is reported in the next section.

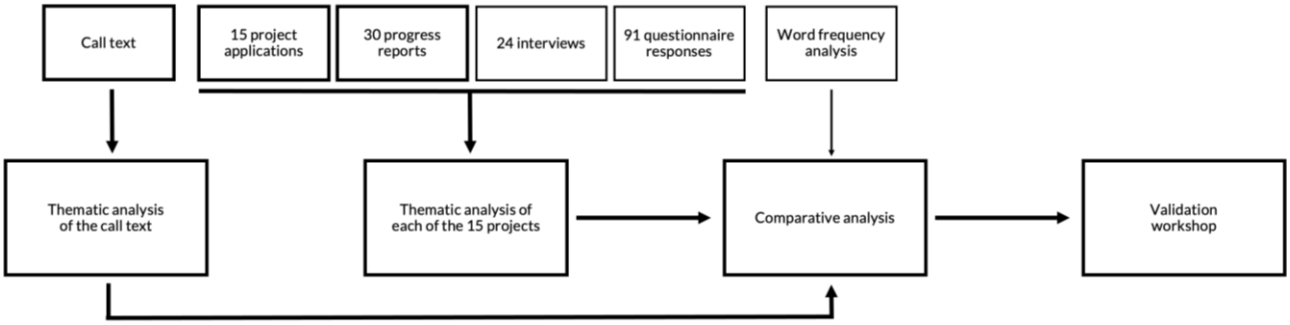

Figure 3: Overview of the analysis process (Smith & Lindkvist forthcoming).

5. Findings

In this section, the findings related to the seven key questions posed to the empirical material are presented separately. They are then discussed together in the final sections of the report.

5.1. Vision and objectives

The call text had a broad focus on accessibility and connectivity in urban areas, which was reflected in the diverse scopes of the funded projects. Several projects focus on multimodal, less car-centric solutions that promoted active mobility, policy changes to influence user behavior, improved quality of life (implicitly or explicitly), and reduced carbon emissions. 10 out of the 15 projects have one or more of these goals, see Table 1.

Table 1: Overview of project objectives.

Project	Pathway	Focus	Objectives
ASAP	Innovation	Sustainable freight solutions	Develop testbeds, build a knowledge platform, and provide policy recommendations.
CATAPULT	Innovation	Inclusive autonomous mobility	Understand user needs and willingness, create use cases, develop a knowledge base and database, and offer policy recommendations.
COCOMO	Research	Integration of sustainable and inclusive micro mobility	Provide insights, develop policies, and create guidelines.
DyMoN	Research	Design of nudging strategies for sustainable transport	Generate knowledge, develop a data hub and tools, conduct demonstrations, and provide policy recommendations.
EASIER	Research	Increase share of and integrate active and shared travel	Generate knowledge, develop tools, establish design principles, and create regulation and policy designs.

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EX-TRA	Research	Develop tools and knowledge to reduce reliance on cars	Develop strategies for a "post-car" city, establish physical design and regulation, and generate knowledge.
GeoSence	Innovation	Design, trial, and evaluate geofencing concepts and solutions	Develop policies, tools, strategies, and an implementation guide.
ITEM	Research	Understanding user needs and developing e-mobility policy	Improve urban e-mobility policies and better understand user needs.
JUSTICE	Research	Accessibility needs for marginalized groups in transport	Develop models, create a framework and indicators, and provide recommendations for accessibility and inclusiveness strategies.
MyFairShare	Innovation	Testing and building knowledge on individual CO2 budgets	Develop testbeds and toolkits, and create guidelines for implementing mobility budgets.
SmartHubs	Research	Sustainable mobility hubs	Develop impact assessment tools, provide an overview of mobility hubs, create guidelines for implementation, and offer policy recommendations.
SortedMobility	Research	Self-organizing railway operations	Develop guidelines and recommendations, and create concepts, models, and algorithms.
TAP	Research	Improve SUMPs with integrated systems planning	Provide practical guidance to complement SUMP guidelines.
TuneOurBlock	Innovation	Validating the superblock model	Develop guidelines, policies, tools, and recommendations.
WalkUrban	Research	Promote walking in cities	Develop local solutions and general recommendations on enabling and hindering factors.

Many projects also set out to improve or expand public transport, either directly or indirectly. Most projects focus on passenger transport and urban mobility, though a few have a different emphasis. For instance, ASAP addresses sustainable freight, while SortedMobility, GeoSense, and TAP take a broader approach to transport.

Justice, equity, and inclusion are frequently mentioned and are explicit focal points in nine projects, even when other themes and objectives vary. Most projects aim to understand user needs, build knowledge platforms, develop tools and databases, design cities or mobility solutions at a high level, and provide policy and regulation recommendations to stakeholders or practitioners. These stakeholders are usually cities or governments, though in some cases, solution providers are also targeted. Some projects, such as ASAP, SortedMobility, and DyMoN, have more technical objectives.

In general, there seems to be a common vision across most projects that the future of cities includes improved quality of life for residents, such as better air quality, lower emissions, enhanced accessibility and connectivity, and increased safety. This vision often involves fewer cars, more travel options for short distances, and a more active lifestyle for the average citizen.

However, there are some conflicts in these goals. For example, increased public transport and projects like SMM offering more travel options could compete with efforts to promote walking and cycling or reduce CO_2 emissions from transportation. Similarly, a proximity-based society, as envisioned by TuneOurBlock, might reduce the need for personal transport but could increase demand for freight transport within cities.

While many applications describe previous research and state-of-the-art developments to justify their objectives, the need for and demand from stakeholders are not always clearly articulated. Additionally, the

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vision for future urban transport, accessibility, and connectivity is often implied through objectives and problem statements rather than being explicitly stated.

5.2. Conceptualizations

The concepts of accessibility and connectivity are frequently used in the documents (see also the findings in Deliverable 4.1); however, their meaning and understanding are somewhat taken for granted and are not clearly defined or elaborated on. There is a discrepancy between the innovation pathway projects and the research pathway projects, with the latter providing more detailed elaboration of the concepts and the suggested methods to address the identified problems in their project applications. Below is an overview of how the projects address the concepts of accessibility and connectivity, including a selection of the academic references cited.

Research pathway:

- COCOMO – Accessibility from a transport equity and transport justice perspective (Pereira et al. 2017; Martens 2017), focusing on place-based and people-based accessibility
- DyMoN – No conceptualization of accessibility or connectivity.
- EASIER – Highlights the need for a people-based, perceived understanding of accessibility and considers the physical environment's impact on people's willingness to use public transport, but lacks a formal definition of accessibility or connectivity
- EX-TRA – Accessibility by proximity (no references) and 'sustainable accessibility' (Bertolini et al., 2005), with no clear definition of connectivity
- ITEM – Accessibility as access to transport and opportunities, connected to social justice aspects (Schwanen, 2020), with no specific definition of connectivity
- JUSTICE – Accessibility as an indicator of spatial justice using the capability theoretical framework (Sen 2005; Beyazit 2010; Pereira et al. 2016), with a typo-morphological model to provide connectivity indexes
- SmartHubs – Accessibility refers to access to different transport modes, while connectivity refers to intermodality
- SortedMobility – No conceptualization of accessibility or connectivity
- TAP – No formal definition of accessibility, though linked to SUMPs (May 2015; Rupprecht Consult 2019). Connectivity is associated with digital connectivity, with no references
- WalkUrban – Accessibility as objective, subjective, and perceived, based on walking-related attitudes, travel satisfaction, and local walking cultures (Klinger et al. 2013; Lättman et al. 2018; Otsuka et al. 2019; van der Vlugt et al. 2019; de Vos et al. 2019)

Innovation pathway:

- ASAP – No conceptualization of accessibility or connectivity
- CATAPULT – No conceptualization of accessibility or connectivity, though a literature review on automation for improved accessibility was conducted without clearly defining accessibility
- GeoSence – No conceptualization of accessibility or connectivity
- MyFairShare – Accessibility and connectivity as the ease of reaching activities and opportunities using an urban transport system, with a focus on reducing negative environmental impacts
- TuneOurBlock – Accessibility and connectivity analyzed in relation to Barcelona's superblocks (Sandholzer et al., 2019), focusing on transforming urban space for better walking and biking access (Nello-Deakin 2019; Creutzig et al. 2020), considering different social groups

This overview illustrates that even the research pathway projects are not consistently clear about addressing the core concepts of the call. Two projects stand out for engaging in a more in-depth discussion on

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accessibility and connectivity though: the Justice and Walk Urban projects. In one project proposal, a dedicated theoretical framework was developed, offering an in-depth discussion of the theoretical entry points to the project. However, the concepts of accessibility and connectivity were not included in this framework. Throughout the material, accessibility generally refers to having access to transport facilities, different urban districts, and local amenities, while connectivity refers to internet connections, intermodality, and sometimes how city districts are linked.

5.3. Problems covered

The call focused on five challenges that the project applications were expected to address:

1. Evolving solutions for an integrated approach to sustainable urban physical mobility and transport, land use, and digital connectivity
2. Developing and supporting the implementation of innovative mobility systems and services with the potential to contribute to sustainable urban mobility
3. Transforming and reorganizing urban spaces to pave the way for sustainable urban mobility and accessibility at the local level, from the street scale to the district
4. Developing effective policy options for achieving a shift toward sustainable urban accessibility and connectivity
5. Changing behaviors and perspectives toward sustainable urban accessibility and connectivity

These challenges were derived from, or intended to address, specific accessibility and connectivity-related issues and problems, referenced from research published in transport policy journals, sustainability transitions literature, and business journals. The problems identified by the call, which the financed projects were expected to address, were as follows:

- Lack of consideration of game interdependencies between mobility and other systems in current planning tools
- Lack of methods and tools to assess the impacts of mobility innovations and unequally distributed benefits
- Poor design of public spaces in relation to current and future sustainable mobility needs (including multiuse of space)
- Conflicts between different scales and actor perspectives in transport planning, along with a lack of citizen involvement in decision-making
- A gap between sustainability ambitions and mobility practices

Table 2 provides a compilation of all the financed projects, detailing the challenges they are addressing, based on the applications and second-year reports, as well as the specific urban accessibility and connectivity problems each project is tackling.

When analyzing the challenges addressed by the financed projects in relation to the call, it becomes clear that most projects focus on the later challenges, where the public sector or academia is likely the primary recipient. Additionally, the development and implementation of solutions, systems, and services are less emphasized in these projects, while the reorganization of public spaces, policy development, and changing behaviors and perspectives receive greater attention A closer examination of individual projects supports this conclusion, showing that SortedMobility, TAP, and to some extent SmartHubs, focus on developing solutions, land use, and digital connectivity. However, only SortedMobility is primarily focused on developing tangible solutions.

In terms of the problems addressed, the projects align with the challenges, with a strong emphasis on user behavior and accessibility for different user groups under various conditions. The goal is to increase

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inclusiveness and sustainability (ecological, social, and economic) for personal travel, with particular attention to social issues, which are frequently cited as underdeveloped in both research and policy. Better policies, regulations, strategies, and city designs that lead to more efficient or active transport, or easier access to daily needs (e.g., fewer cars and less private travel), are recurring themes. Some projects, however, focus on other issues such as traffic management and sustainable freight in urban settings. Additionally, accessibility problems and concepts are discussed more frequently and in greater detail compared to connectivity, which is mentioned less often and usually only when paired with accessibility.

The problems addressed in the projects are generally supported by references to earlier research, and it is implied that the results are necessary for stakeholders involved in or connected to the projects. This stronger focus on research can be explained by the fact that ten out of the 15 projects chose a research-oriented pathway.

Table 2: Overview of addressed challenges and problems

Project	Challenges	Key words	Accessibility and connectivity problems addressed
ASAP	2	Urban logistics testbeds on underused resources; SULP information and interaction platform; Financial sustainability and platform integration	Decreased efficiency due to congestion problems; Increased transport and delivery (due to e-commerce); Pollution; Helping cities with limited resources adopt good practices
CATAPULT	2, 4	User needs and requirements; Inclusive mobility services; Sustainable automated mobility; Inclusive urban policies	User groups such as the elderly, children, and impaired persons have received little attention in the development of automated services
COCOMO	2, 3	Disruptive mobility; Sustainability; Equity; Public space; Multimodality	SMM will use the same space as other mobility; Limited insight into the implications of this and how public space needs to be designed; Dependency on SMM and current city configuration
DyMoN	5	Sustainable urban mobility; Data-based strategies for urban mobility; Nudging methods; Change of mobility behavior	Citizens are included in transport planning (SUMP), but there is still large car dependency; More (digital) measures are needed for a shift than just access to sustainable transport and increased awareness
EASIER	3, 4, 5	Personal urban mobility; User preferences; Physical, operational, and organizational design	Private cars are CO2-intensive, while public transport is usually more sustainable and requires less space, but no change has been seen despite desirability; Increased focus on smooth integration and passenger preferences
EX-TRA	3, 4	Convivial public spaces; Accessibility by proximity; Alternative mobility options; City street experiments	Encroachment of public space; Lack of physical movement; Social exclusion; Fragmentation of communities and landscapes; Loss of land and biodiversity; Less focus on accessibility and resistance to change
GeoSence	2, 4, 5	Geofencing; Urban traffic management and planning; Implementation strategies	Urbanization leads to more complex traffic and interactions; Increased pollution, congestion, and accidents; Expensive to invest in new physical infrastructure (digital solutions are cheaper); Data management, governance, policy development, and user acceptance for geofencing solutions; Business models and cooperation structures needed

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ITEM	4, 5	E-mobility; Justice; Accessibility	Too much focus on technology and economy; User research focused on early adopters; Possibilities from other e-mobility solutions than private cars under-researched
JUSTICE	3, 4	Inclusive city; Spatial justice; Participative approach	Justice and inclusion are seldom included in transport planning; Several barriers for inclusion, such as economic, social, and physical hurdles, as well as digital competence issues for public transport
MyFairShare	4, 5	Mobility budget; Transport equity; Behavior change policies	Radical mobility behavior changes are necessary for climate targets (green cars are not enough); Hard to arouse a sense of personal responsibility due to "diffuse" climate goals; High discrepancy between climate awareness and mobility behavior; Need to break down goals to a personal level
SmartHubs	(1, 2, 3, 4), 5	Mobility hubs; Shared mobility; User-centric and co-design tools	Current mobility policies are not user-centric, inclusive, or sustainable; Users should be involved earlier in the planning stages; Mobility hubs are not integrated into current policies; Shared mobility is not widely adopted, possibly due to insufficient connection
SortedMobility	1	Sustainable urban mobility growth; Self-organizing system; Railway traffic management	Hard to provide frequent and reliable railway services where there is low demand; High demand results in infrastructure limitations; There is a need for better traffic management strategies; Freight and personal transport compete on the rail, requiring balance; More dynamic, flexible, real-time adaptation needed in train traffic
TAP	1	Urban planning; Triple access system; Deep uncertainty; SUMPs	SUMPs need to be more flexible and include digital connectivity (e.g., in response to COVID-19)
TuneOurBlock	3, 4, 5	Superblock; Urban transformation; Co-creative urbanism	Urban areas are designed for motorized vehicles, limiting freedom, safety, and accessibility; Urban design can lead to social and economic exclusion, not addressing the needs of all or providing accessibility to certain areas; City design and lack of alternatives promote private vehicles; Long commutes and increased pollution result from traditional city planning; More interconnected and integrated urban layouts are needed
WalkUrban	5	Walkability; Objective, subjective, and perceived accessibility; Public transport	Barriers to walking create sustainability, equity, and independence issues; Vulnerable groups may be especially affected

Overall, our analysis of the project portfolio shows a stronger focus on policy, behavior, perspectives, and public spaces than on developing tangible solutions, services, or systems. The primary problem owners and target groups are mainly decision-makers in the public sector (e.g., cities or governments) and end users in the form of citizens. Recurring themes such as accessibility, inclusion, justice, and reducing reliance on cars or private mobility for personal transport are also widely emphasized.

5.4. Consortia

Project proposals were required to include a minimum of three eligible partners from at least three different participating countries, which included Austria, Belgium, Denmark, Cyprus, France, Germany, Italy, Latvia, the Netherlands, Norway, Poland, Romania, Slovenia, Sweden, Turkey, and the United Kingdom. Additionally,

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project consortia were allowed to collaborate with non-funded partners. These partners could come from various sectors within the research and innovation landscape and across multiple disciplines. The call particularly emphasized the importance of transdisciplinary approaches to foster the co-creation of project ideas and designs.

Out of the 21 funding organizations involved, 15 allowed funding for cities, 17 for companies, and 14 for non-governmental organizations (NGOs). However, given the complex responsibilities associated with being the lead applicant and the focus on leveraging previous experience from R&D projects, it could be argued that the role of lead applicant was primarily accessible to organizations with experience managing European level projects.

Among the 135 project co-applicants of the projects that secured funding, 46% represent universities or research institutes, 21% are large companies, 4% are non-profit research organizations, 13% are cities or municipalities, and 14% are other public organizations (JPI Urban Europe 2021). Civil society organizations are notably absent from this list, though in some cases, such as the JUSTICE project, they are involved as cooperative partners.

The project coordinators, or main applicants, for all 15 projects are research organizations based in Western Europe. These coordinators are located in Austria (5), the Netherlands (3), France (2), and Denmark, Germany, Norway, Sweden, and the United Kingdom (one each). Cities and regional authorities are involved in every project consortium except one (SortedMobility). However, their roles are often peripheral, as they lead work packages in only two projects (TuneOurBlock and WalkUrban) and are not part of five project consortia. Even when cities and regions are included as partners, they are not always central to the decision-making processes, as is the case with projects like ASAP and SmartHubs. In most cases, cities and regions participate as cooperative partners, with their roles outlined in letters of intent. The roles of cities and regions (and their companies) in the projects are distributed as follows:

- ASAP – Co-applicant; Co-operation partner
- CATAPULT – Co-operation partner
- COCOMO – Co-operation partner
- DyMoN – Co-applicant; Co-operation partner
- EASIER – Co-applicant; Co-operation partner
- EX-TRA – Co-applicant; Co-operation partner
- GeoSence – Co-applicant; Co-operation partner
- ITEM – Co-operation partner
- JUSTICE – Co-operation partner
- MyFairShare – Co-applicant; Co-operation partner
- SmartHubs – Co-applicant[1]
- SortedMobility – None[2]
- TAP – Co-applicant; Co-operation partner[3]
- TuneOurBlock – Co-applicant; Co-operation partner; Work package leader
- WalkUrban – Co-applicant; Co-operation partner; Work package leader

Companies and NGOs generally take on somewhat more active roles compared to other partners, particularly consultancies that specialize in European-level research and innovation projects (e.g., Lorenz Consult). However, research organizations continue to dominate both the workload and decision-making processes in the ENUAC projects. For instance, in the TAP project, the four research institutions were responsible for 177 person-months, while the remaining eleven person-months were divided among the other eleven organizations within the consortium.

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Despite this, most applications highlight the importance of their international and interdisciplinary consortia, stressing that such diversity is crucial for the successful execution of the projects and ensuring that their outcomes are translated into real-world impact. The reasoning behind consortium composition is often outlined as follows: research organizations contribute scientific expertise and carry out the bulk of the work, while cities and regions offer local insights, engage with citizens and stakeholders, and help integrate the findings into policy. NGOs and companies, on the other hand, bring in fresh ideas and innovative tools.

We also sought to explore the processes behind the formation of these consortia and the negotiation of project roles and designs. However, the documents reviewed provided minimal information on these aspects.

5.5. Experiments

The call offered two pathways: research and innovation. For the research pathway, it welcomed an urban living lab approach, and for the innovation pathway, it encouraged this approach while emphasizing the importance of experimentation, testing, implementation, evaluation, and dissemination of results. All innovation-focused projects were expected to closely collaborate with practitioners and other stakeholders throughout the process.

In terms of objectives, the call stressed the importance of involving various stakeholders, including the public, private entities, citizens, and end users, in co-creating solutions for sustainable and inclusive mobility and freight transport. Beyond simply involving stakeholders, the call emphasized that the purpose of the co-creation is not necessarily to generate new knowledge but to address urban sustainability challenges and create synergies from these dilemmas. Experiments should therefore be embedded in everyday urban life, situated where the process and challenge occur, often but not exclusively at the neighborhood level, according to the call.

Accordingly, nearly all applications emphasized co-creation and experimentation with local stakeholders and citizens as core components of their project designs or as aspirations to help policymakers achieve these goals:

- ASAP will “provide testing structures (testbeds) for innovative urban logistics systems” (p. 2)
- CATAPULT will develop policies for “co-creation, evaluation and implementation” (p. 4)
- COCOMO “engages in co-creation with users and stakeholders” to develop design and planning guidelines for sustainable and inclusive implementation of shared micro mobilities” (p. 2)
- “The DyMoN nudging framework will be co-created in a multi-actor participatory approach” (p. 3)
- EASIER “will co-create knowledge-cases, data and methods” (p. 4)
- “Central to EX-TRA’s approach are transition experiments in city streets” (p. 3)
- The objective of the GeoSence project is to “design, trial and evaluate geofencing concepts” (p. 5)
- ITEM will “co-produce understandings of how urban and transport planning regarding sustainability and accessibility can be strengthened through inclusive EM transition processes” (p. 2)
- To assess specific populations’ accessibility, “in situ experiments and focus groups will be carried out with actual older, underprivileged and impaired people” in the JUSTICE project (p. 9)
- MyFairShare will test the potential of individual mobility budgets through “six living labs” (p. 2)
- “SmartHubs utilises the Urban Living Lab concept involving a high level of stakeholder participation, co-creation, co-production, learning-loops, experimental approaches to improve urban life.” (p. 4)
- SORTEDMOBILITY will use “close collaboration between academic and key rail stakeholders” (p. 2)
- The TAP project is “highly collaborative and involves seven case study cities in five countries” (p. 2)
- In TuneOurBlock “municipal planners, practitioners, researchers, and NGOs, co-create effective and transferrable guidelines, policy options and tools for implementing Superblocks” (p. 2)
- The research in WalkUrban “will be carried out in close collaboration with local stakeholders” (p. 2)

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Several factors influenced the strong focus on co-creation and experimentation. First, engaging stakeholders, including citizens, plays a vital role in securing their buy-in and generating interest in the process. Second, finding the best solutions often requires a trial-and-error, iterative approach. Third, active participation helps stakeholders learn more effectively by allowing them to experience the process firsthand.

As demonstrated by the SmartHubs project, the projects had a wide range of ambitions for their experimental activities. These ambitions included developing and demonstrating solutions, as well as creating new participatory methodologies and testing the applicability of tools, concepts, and findings. To meet these objectives, the applications referenced various methods for co-creating experiments, including:

- For data collection: Interviews, (e.g., ITEM), walkalongs (e.g., WalkUrban), workshops (e.g., ASAP), questionnaires (e.g., CATAPULT), focus groups (e.g., COCOMO), mobility labs (e.g., CATAPULT), and Delphi studies (e.g., TuneOurBlock).
- For developing concepts and recommendations: Policy workshops (e.g. COCOMO), hackatons (e.g., DyMoN), online platforms (e.g., EX-TRA), and feedback cycles (e.g., TuneOurBlock).
- For experimenting: Simulations (e.g., SortedMobility), choice experiments (e.g. MyFairShare), serious games (e.g., CATAPULT), field tests (e.g., GeoSence), prototyping (e.g., SmartHubs), proof of concepts (e.g., DyMoN), tactical urbanism interventions (e.g. EASIER), and real-world tests (e.g., TAP).

This list encompasses both top-down and bottom-up approaches. Several applications, such as EASIER, JUSTICE, and WalkUrban, emphasized the importance of bottom-up strategies. However, given the limited involvement of citizen/user representatives and local stakeholders in the decision-making and execution processes of most projects (as discussed in the previous section), we contend that the experimentation methodologies, on average, tend to follow a more conventional top-down approach.

In their second-year reports, several projects noted delays in their experimentation activities. These delays were attributed to various factors, including HR challenges (SortedMobility, WalkUrban), incorrect assumptions and underestimation of the workload (JUSTICE, SmartHubs, and ASAP), lack of respondent engagement (COCOMO and WalkUrban), greater internal communication needs to establish common understandings and working methods (MyFairShare, ASAP, and GeoSence), and difficulties in managing external stakeholders (COCOMO and TAP).

5.6. Impact logics

The call text outlined different expectations for projects within the research and innovation pathways. For the research pathway, the goal was to answer broad questions like "How do cities function" and "What works to improve cities" in a way that adds to the general body of knowledge and helps decision-makers. Innovation pathway projects, on the other hand, were expected to focus on the development, testing, and implementation of new products, services, policies, and processes to improve economic, social, or environmental sustainability in cities.

Despite these differences, all projects were required to contribute to transport policy objectives at various scales—local, regional, national, and European. Projects were also expected to engage stakeholders to ensure results are translated into local action and widely disseminated. The call asked applicants to detail two main strategies: stakeholder engagement and wider dissemination plans.

Most project designs reflected this, involving local partners like municipal organizations and industry as key actors to implement results and meet the objectives of the call. Local organizations were seen as benefiting through learning-by-doing, expanding networks, and gaining insights or tools tailored to their needs. For example, the ITEM project reported that policymakers in its case-study cities gained new problem understandings, policy insights, and capacity-building, alongside the development of customized tools.

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Industry partners were also expected to apply new insights directly in their operations. Co-creation was often emphasized as essential to achieving results both during and after the projects in the project applications.

Organizations involved as co-operative partners were expected to apply the project results in other cities across Europe. Many projects formed advisory or reference committees to help with wider dissemination. Other common channels for impact included academic publications, patents, websites, social media, and established pan-European networks. Projects hoped that their experiments would serve as positive examples, paving the way for broader adoption of the tested concepts and tools.

However, when reporting progress, many projects acknowledged that measuring impact from a single project, especially in the short term, is difficult. They often noted that impact would become clearer by the end of the project or afterward. As a result, most status reports focused on dissemination activities rather than tangible impact, with many statements written in future tense, regardless of whether the project followed the research or innovation pathway. By the second year, some projects had not yet begun translating their outputs into actionable impacts. For example, the JUSTICE project had yet to produce insights or tools valuable to stakeholders, and ITEM had not established its dissemination committees. Others were still focused on raising awareness rather than driving action. Still, some projects, like EX-TRA and SortedMobility, reported growing evidence of the value of their work, while others, like TuneOurBlock, reported tangible impacts.

5.7. The urban context

In the call text, the research funding organization opened up for different urban conditions and provides applicants with multiple ways to define the urban context in which their project will operate (JPI Urban Europe 2019, p. 5):

> *"To add to the complexity, the urban mobility and connectivity 'system' is ingrained and interwoven in the existing urban fabric, both in physical terms and in terms of functionality, with an increasing interdependency with energy and information systems, and with the entry of new non-traditional global actors in the mobility and transport market. Interventions in mobility and transport have short- and long-term consequences for travel and logistics choices (route, travel mode, activity patterns including shopping patterns, retail concepts), economic development, and spatial structure. At the same time, changes in demography, macro-economic development, and the development of completely new business models and land-use patterns impact mobility and transport."*

The call's ambition can be interpreted as an invitation for applicants to adopt a broad understanding of how to conceptualize the urban context for their projects. The urban perspective was, moreover, defined in three ways in the call. Firstly, basic urban research refers to fundamental research aimed at understanding how cities function, either as individual entities or as part of a network of cities. This research seeks to expand general knowledge through traditional scientific methods. Secondly, applied urban research involves collaboration with citizens and representatives from non-academic institutions (NGOs, citizen organizations, companies, governments) to bring in the practitioners' perspective. The goal here is to co-produce knowledge that is relevant for stakeholders. Applied urban research is designed to be practical and directly applicable, with results that are likely to influence real decisions and policy. Thirdly, urban innovation and implementation take applied research further by promoting the development of new policies, practices, services, products, or processes. This can include integrated systems, tools, services, and data. The aim is to have a tangible impact during the project phase through experimentation, testing, implementation, evaluation, and dissemination of results, all carried out in close collaboration with practitioners and other stakeholders.

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The Easier project, a research pathway project, responds to the call text by highlighting the urban environment as a space marked by conflicting legislation and unequal access to well-maintained public spaces. The project also notes regional and national differences in planning as critical factors for understanding urban conditions and developing sustainable strategies. It emphasizes governance structures and tactical urban elements in the built environment as key to creating accessible urban environments, with mobility hubs playing a crucial role.

For other projects, the urban context refers to a specific city or cities connected through the research project, which require innovative solutions due to congestion, traffic externalities, and unsafe and unhealthy conditions. One example is the ASAP project, an innovation pathway project focusing on cities with access to waterways (rivers or lakes). The project describes what it calls "sleeping assets," referring to underutilized infrastructure that could relieve street networks of truck traffic and increase road capacity for other users.

Most projects within the ENUAC research portfolio treat the urban as the site where the project takes place. However, few projects reflect on the three levels of research concerning the urban context outlined in the call text.

6. Discussion

In this section, the analysis findings related to two of the three underpinning objectives are discussed: synthesizing the type of research encouraged and developed within the ENUAC portfolio and identifying research and implementation gaps. Findings related to the third objective—exploring what the DUT could do to improve the transformative capacity of the ENUAC portfolio—will be discussed in the next and final section of the report.

6.1. High-level overview of the ENUAC project portfolio

To this end, the analysis illustrates that the 15 projects funded by the first ENUAC call share an implicit vision of cities characterized by higher air quality, improved accessibility, better connectivity, and increased safety. However, they rarely discuss the inherent goal conflicts that may arise in pursuing these objectives. The projects aim to address problems primarily related to personal mobility, with public organizations typically identified as the needs owners. Previous European studies were commonly cited as evidence for the importance of addressing these issues, and the problem owners were generally public sector organizations and/or end-users, such as citizens.

The projects set out to deliver knowledge, platforms, policy recommendations, and various tools. However, they do not elaborate on the theoretical and conceptual understandings of connectivity and accessibility in either their applications or reports. Moreover, few projects provide detailed descriptions of the specific urban contexts or the motivations behind the chosen scale of their initiatives.

Most project applications emphasize the importance of international and intersectional collaboration, with a pan-European organization generally viewed as essential for promoting cohesive planning across the involved cities. Nevertheless, all project coordinators are from Western Europe, and research organizations dominate both the work and decision-making processes. Cities and regions play marginal roles in executing the work of most projects.

While all applications highlight co-creation and experimentation, there are large variations in both experimentation objectives and participatory methods. On average, however, the experimentation approaches tend to follow a conventional top-down logic. The projects have two main mechanisms for transforming outputs into impact beyond the experiments: co-applicants are expected to benefit from

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"learning by doing" and from tailor-made guidelines and tools, while cooperative partners and networks are designed to ensure wider impact.

6.2. Research and implementation gaps

The analysis revealed three significant research and implementation gaps, that are mismatches between the stated intent of the ENUAC call and the scope of the ENUAC project portfolio. These gaps have relevance beyond DUT's investments in research and innovation projects focused on urban accessibility and connectivity, as further elaborated in Smith and Lindkvist (*forthcoming*).

Firstly, there is a power imbalance within the portfolio that has resulted in research organizations dominating both the work and decision-making processes in the projects, despite the emphasis on co-creation with local stakeholders in the call. This is problematic given that local stakeholders are crucial for translating project outputs into lasting impact. Factors contributing to this mismatch may include processes tailored to research organizations, the pan-European scope of JPI Urban Europe, and urban austerity limiting the capacity of municipalities and regions.

Secondly, the portfolio suffers from an innovation bias, placing much more emphasis on supporting niche innovations than on destabilizing the existing regime. This approach contrasts with the theory of change that underpins the multi-level perspective on sustainability transitions, which informed our analysis. The primary factor explaining this mismatch is likely the significant challenges associated with intentional destabilization.

Thirdly, the projects rarely elaborate on key concepts and the complexities of transferability. This lack of focus on conceptualization and transferability reflects the call text. The risk here is that the projects may not align with the practical and empirical needs of the participating local stakeholders.

7. Recommendations to DUT

To address these gaps, we recommend DUT to issue more flexible and democratic funding calls so that they accommodate a broader spectrum of project approaches. We, moreover, see a need to explore new approaches to ensuring that local stakeholders can be, and are, actively involved in project formulation, execution, decision-making, and afterlife. Additionally, we present the following recommendations in relation to the seven key questions that guided the analysis, collectively suggesting that DUT require applicants to be clearer about what, how, why, and where:

- **Visions and objectives**: Require project applicants to state which accessibility- and connectivity-related visions or objectives the project intends to contribute to. Additionally, encourage applicants to discuss whether and why any conflicts might arise between the project's objectives and alternative visions, objectives, or interpretations of the central concepts.
- **Conceptualizations**: Require applicants to define how central concepts are analytically understood, conceptualized, and operationalized, while acknowledging that the level of analytical depth will vary depending on whether the project is research-, innovation-, or implementation-focused.
- **Problems covered**: Analyze why (i) solutions for an integrated approach and (ii) the development and implementation of innovative mobility systems and services were addressed less by the funded projects than the other three challenges listed in the call, and adjust the requirements accordingly, for instance by reducing the emphasis on contributing to *policy*.
- **Consortia**: Review the demands placed on coordinators to facilitate leadership by non-Western and non-academic organizations. Consider earmarking specific roles or a percentage of the funding for 'problem owners,' such as cities and regions. Furthermore, require applicants to demonstrate how

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the 'problem owners' have been involved in formulating problem descriptions, and describe how the consortia will contribute to strengthening transition coalitions and agendas beyond the project.

- **Experiments**: Analyze why only three projects self-categorize as urban living labs despite the call's encouragement of this approach. Also, ask applicants to explain how their experimental approaches address procedural justice and adaptability.
- **Impact logics**: Encourage applicants to discuss which theory of change their proposal is based on and how the project organization aligns with this theory. Require all applications to outline impact mechanisms for both during and after the project and ask status reports to track activities in relation to these mechanisms.
- **Urban context**: Require applicants to reflect on the type of urban contexts the project is engaging with, and which contexts the results thus might be transferable to. Applicants should also be asked to reflect on challenges connected to working within cross-national urban planning and governance structures to enhance learning on the pros and cons of multinational and cross-national projects.

8. References

Brenner, N. (2019). *New urban spaces : urban theory and the scale question*. Oxford University Press.

Folco, P., Gauvin, L., Tizzoni, M., & Szell, M. (2023). Data-driven micromobility network planning for demand and safety. *Environment and planning B: Urban analytics and city science*, *50*(8), 2087-2102.

Fuenfschilling, L., & Truffer, B. (2014). The structuration of socio-technical regimes—Conceptual foundations from institutional theory. *Research policy, 43*(4), 772-791.

Geels, F. W. (2002). Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study. *Research policy, 31*(8-9), 1257-1274.

Geurs, K. T., & Van Wee, B. (2004). Accessibility evaluation of land-use and transport strategies: review and research directions. *Journal of Transport geography*, *12*(2), 127-140.

Hebinck, A., Diercks, G., von Wirth, T., Beers, P. J., Barsties, L., Buchel, S., ... & Loorbach, D. (2022). An actionable understanding of societal transitions: the X-curve framework. *Sustainability Science, 17*(3), 1009-1021.

Jacobs, J. (2011). *The death and life of great American cities* (50th anniversary ed., 2011 Modern Library ed.). Modern Library.

JPI Urban Europe. (2019a). Joint call for proposals for research and innovation projects on urban accessibility and connectivity (European Commission grant no 875022).

JPI Urban Europe. (2021). ENUAC projects catalogue 2021.

Kemp, R., Schot, J., & Hoogma, R. (1998). Regime shifts to sustainability through processes of niche formation: the approach of strategic niche management. *Technology analysis & strategic management, 10*(2), 175-198.

Korkmazyürek, B., Kahraman, S., & Polat, E. (2023). Connectivity of Urban Spaces Typology and Urban Mobility Topology. *Kent Akademisi*, *16*(3), 1477-1496.

LeGates, R. T., & Stout, F. (2015). *The City Reader* (6th ed.). Taylor & Francis Group.

Leydesdorff, L. (2006). The knowledge-based economy and the triple helix model. *Understanding the Dynamics of a Knowledge Economy, Elgar, Cheltenham*, 42-76.

Loorbach, D. (2007). *Transition management. New mode of governance for sustainable development*. Utrecht: International Books.

This project is supported by the European Commission and funded under the Horizon 2020 ERA-NET Cofund scheme under grant agreement N° 875022

Loorbach, D. (2010). Transition management for sustainable development: a prescriptive, complexity- based governance framework. *Governance, 23*(1), 161-183.

Loorbach, D. (2022). Designing radical transitions: a plea for a new governance culture to empower deep transformative change. *City, territory and architecture,* 9(1), 30.

Markard, J., Raven, R., & Truffer, B. (2012). Sustainability transitions: An emerging field of research and its prospects. *Research policy, 41*(6), 955-967.

Massey, D. (2012). Power-geometry and a progressive sense of place. In *Mapping the futures* (pp. 60-70). Routledge.

Mohamad, W. W., & Said, I. (2014, February). A review of variables of urban street connectivity for spatial connection. In *IOP Conference Series: Earth and Environmental Science* (Vol. 18, No. 1, p. 012173). IOP Publishing.

Miller, E. J. (2018). Accessibility: measurement and application in transport planning. *Transport Reviews*, *38*(5), 551-555.

Nel, D., Bruyns, G., & Higgins, C. D. (2019). Urban design, connectivity and its role in building urban spatial resilience.

Rogers, E. M. (1995). *Diffusion of innovations.* The Free Press

Rotmans, J., Kemp, R., & Van Asselt, M. (2001). More evolution than revolution: transition management in public policy. *Foresight, 3*(1), 15-31.

Rittel, H. W., & Webber, M. M. (1973). Dilemmas in a general theory of planning. *Policy sciences*, *4*(2), 155-169.

Selvi, A. F. (2019). Qualitative content analysis. In *The Routledge handbook of research methods in applied linguistics* (pp. 440-452). Routledge.

Weaver-Hart , A. 1988 . Framing an innocent concept and getting away with it . *UCEA Review* , 24 (2) : 11 – 12.

Wee, B.V., Annema, J.A. & Banister, D. (red.) (2013). *The transport system and transport policy: an introduction*. Cheltenham, UK: Edward Elgar.

Zhao, X., Li, X., Zhou, Y., & Li, D. (2020). Analyzing urban spatial connectivity using night light observations: a case study of three representative urban agglomerations in China. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, *13*, 1097-1108.

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